CLAIMS

I/We claim:

[c1] 1. A method of processing data for conditioning T-wave segments of a waveform used in estimating T-wave alternans, comprising:

ascertaining T-wave segments from a physiologic signal having substantially repetitive waveforms of a heart beat;

determining a correction factor based on a set of the repetitive waveforms and a reference waveform; and

applying the correction factor to the T-wave segments to compensate for noise in the signal.

[c2] 2. The method of claim 1 wherein ascertaining T-wave segments comprises (a) determining an average/median beat estimate having a QRS complex and a T-wave segment and (b) cross-correlating the QRS complexes of the repetitive waveforms with the QRS complex of the average/median beat estimate to align the beats.

[c3] 3. The method of claim 1 wherein ascertaining T-wave segments comprises determining a heart rate according to an R-R interval and a P-Q interval, and computing a T-wave duration period for the T-wave segment in the beat based on the R-R interval and the P-Q interval.

[c4] 4. The method of claim 3 wherein ascertaining the T-wave segments further comprises defining an onset time corresponding with the end of a Q-wave segment and an endpoint at the T-wave duration period after the onset time.

[c5] 5. The method of claim 1 further comprising determining the reference waveform by computing an average/median beat waveform from a set of the repetitive waveforms.

[c6] 6. The method of claim 5 wherein determining the correction factor comprises determining an amplitude gain factor and/or a DC shift factor by comparing the average/median beat waveform with individual waveforms in the set of repetitive waveforms.

[c7] 7. The method of claim 5 wherein determining the correction factor comprises determining an amplitude gain factor and/or a DC shift factor by comparing a P-S segment of the average/median beat waveform with corresponding P-S segments of individual waveforms in the set of repetitive waveforms.

[c8] 8. The method of claim 1 wherein applying the correction factor comprises (a) determining an amplitude gain factor and/or a DC shift factor, (b) computing a polynomial function F_G for the amplitude gain factor and F_C for the DC shift factor, and (c) normalizing the T-wave segments according to the following equation.

$$ECG_{corrected}(i) = \frac{ECG(i) - F_C(i)}{F_G(i)}$$

[c9] 9. A method for improving signal to noise ratio in data obtained from a physiologic signal representative of a subject's heart activity having plurality of substantially repeating physiologic waveforms, the method comprising:

(a) isolating a plurality of repeating physiologic waveforms from the signal to define a plurality of isolated waveforms;

(b) computing a representative waveform from the isolated waveforms;

(c) comparing the representative waveform with individual isolated waveforms to determine a correction factor having an amplitude gain correction factor *G(m)* and/or a DC shift correction factor *C(m)*; and

(d) establishing a correction curve fit to the correction factor from the isolated individual waveforms.

[c10] 10. The method of claim 9, further comprising normalizing the isolated individual waveforms by applying the correction curve to the isolated individual waveforms.

[c11] 11. The method of claim 9 further comprising deriving a respiration rate from a sequence of amplitude gain correction factors *G(m)* after determining the correction factor in procedure (c).

[c12] 12. The method of claim 9, further comprising deriving a respiration rate by computing from a sequence of amplitude gain factors *G(m)* the time between peaks of the sequence, the average time between a plurality of peaks in the sequence, and/or the peak in the power of a Fourier transform computed from the sequence.

[c13] 13. The method of claim 9 further comprising repeating procedures (a) through (d) for each of a plurality of signals representative of a subject's heart activity.

[c14] 14. The method of claim 9 further comprising acquiring the physiological signal while performing a stress test on the subject.

[c15] 15. The method of claim 9 further comprising acquiring the physiological signal by obtaining ECG data of the subject's heart.

[c16] 16. The method of claim 9 wherein identifying the T-wave segments comprises (a) determining an average/median beat estimate having a QRS complex and a T-wave segment and (b) cross-correlating the QRS complexes of the repetitive waveforms with the QRS complex of the average/median beat estimate to align the beats.

[c17] 17. The method of claim 9 wherein identifying T-wave segments comprises temporally identifying an onset and a conclusion of individual T-wave segments.

[c18] 18. The method of claim 9 wherein identifying T-wave segments comprises temporally identifying an onset and a pre-determined T-wave duration to set a time-defined conclusion of at least some of the T-wave segments.

[c19] 19. The method of claim 9 further comprising aligning a plurality of the T-wave segments before computing the estimated alternan signatures.

[c20] 20. The method of claim 19 wherein aligning the T-wave segments comprises using a consistently identifiable portion common to several of the repeating waveforms to temporally align the T-wave segments before computing the estimated alternan signatures in procedure (b).

[c21] 21. The method of claim 9 further comprising determining a beat estimate from the repeating physiological waveforms and using the beat estimate to establish a best estimate for the onset of the T-wave segments.

[c22] 22. The method of claim 21 wherein the best estimate for the onset of the T-wave segments comprises a time-window definition for identifying the T-wave segments.

[c23] 23. A system for collecting and conditioning data regarding T-wave segments for use in estimating T-wave alternans, the system comprising:

a data source configured to obtain and/or retain digitized data of a physiologic signal having substantially repetitive waveforms of a heart beat; and

a computer operatively coupled to the data source, the computer having a computer operable medium containing instructions for (a) ascertaining T-wave segments from the physiologic signal, (b) determining a correction factor related to noise in the signal based on a set of the repetitive waveforms and a reference waveform, and (c) applying the correction factor to the T-wave segments to compensate for noise in the signal.

[c24] 24. The system of claim 23 wherein the data source further comprises a stress test device and electrodes for recording the physiologic signal.

[c25] 25. The system of claim 23 wherein the instructions contained in the computer operable medium for ascertaining T-wave segments comprise (a) determining an average/median beat estimate having a QRS complex and a T-wave segment and (b) cross-correlating the QRS complexes of the repetitive waveforms with the QRS complex of the average/median beat estimate to align the beats.

[c26] 26. The system of claim 23 wherein the instructions contained in the computer operable medium for ascertaining T-wave segments comprise determining a heart rate according to an R-R interval and a P-Q interval, and computing a T-wave duration period for the T-wave segment in the beat based on the R-R interval and the P-Q interval.

[c27] 27. The system of claim 23 wherein the instructions contained in the computer operable medium for ascertaining T-wave segments comprise defining an onset time corresponding with the end of a Q-wave segment and an endpoint at a predetermined T-wave duration period after the onset time.

[c28] 28. The system of claim 23 wherein the instructions contained in the computer operable medium for determining a correction factor related to noise further comprise determining the reference waveform by computing an average/median beat waveform from a set of the repetitive waveforms.

[c29] 29. The system of claim 23 wherein the instructions contained in the computer operable medium for determining a correction factor related to noise comprise determining an amplitude gain factor and/or a DC shift factor by comparing the average/median beat waveform with individual waveforms in the set of repetitive waveforms.

[c30] 30. The system of claim 23 wherein the instructions contained in the computer operable medium for determining a correction factor related to noise comprise determining an amplitude gain factor and/or a DC shift factor by comparing a P-S segment of the average/median beat waveform with corresponding P-S segments of individual waveforms in the set of repetitive waveforms.

[c31] 31. The system of claim 23 wherein the instructions contained in the computer operable medium for applying the correction factor comprise (a) determining an amplitude gain factor and/or a DC shift factor, (b) computing a polynomial function F_G for the amplitude gain factor and F_C for the DC shift factor, and (c) normalizing the T-wave segments according to the following equation.

$$ECG_{corrected}(i) = \frac{ECG(i) - F_C(i)}{F_G(i)}$$